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(71) Applicant 000002185  
Sony Corporation  
6-7-35 Kitashinagawa,  
Shinagawa-ku, Tokyo

(72) Inventor Toru Ogawa  
c/o Sony Corporation  
6-7-35 Kitashinagawa,  
Shinagawa-ku, Tokyo

(74) Attorney Takahisa Sato

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(54) Invention

Semiconductor Device and its manufacture

(57) Abstract

Purpose: To provide a semiconductor device and its manufacturing method capable of avoiding the decomposition of a reflection preventive film having stoichiometrically unstable bonds as well as forming a highly stable fine pattern.

Constitution: A reflection preventive film 12 having stoichiometrically unstable bonds is formed on an underneath substrate; a protective film 14 suppressing the change in the optical requirements of this reflection preventive film 12 is formed; and then a resist film is formed on this protective film 14 directly or through the intermediary of an interlayer film so as to be processed according, to a specific pattern using photolithography.

Coverage of patent

Claim 1 – The manufacturing method of a semiconductor device which processes an underneath substrate. The underneath substrate has a resist film formed by a specific pattern using photolithography, and the resist film is used as a mask for etching. The manufacturing method includes the following processes: forming a reflection preventive film having stoichiometrically unstable bonds on the underneath substrate; forming a protective film suppressing the change in the film's optical requirements on the reflection preventive film; forming a resist film on this protective film directly or through the intermediary of an interlayer film; processing this resist film by a specific pattern using photolithography.

Claim 2 – The manufacturing method of the semiconductor device mentioned in the Claim 1 which is constituted by a reflection preventive film,  $\text{Si}_x\text{O}_y\text{N}_z$  (x is a real number that does not include 0, y is a real number that includes 0 and z is a real number that does not include 0).

Claim 3 – The manufacturing method of the semiconductor device mentioned in the Claim 1 and Claim 2 whose protective film is constituted by the same quality of the material with the optical characteristics as the interlayer film formed on the protective film.

Claim 4 - The manufacturing method of the semiconductor device mentioned in the Claim 1 through 3: its protective film is constituted by an inorganic film with refracting rate, n, is between 1.4 and 1.7 to wavelength for exposure light; its interlayer film is constituted by a silicon oxide film.

Claim 5 - The manufacturing method of the semiconductor device mentioned in the Claim 1 through 4 whose protective film is formed by the plasma TEOS method.

Claim 6 - The manufacturing method of the semiconductor device mentioned in the Claim 1 through 5 whose protective film is formed at the temperature below that of the reflection preventive film is formed.

Claim 7 - The manufacturing method of the semiconductor device mentioned in the Claim 1 through 6 whose protective film is an insulation film and also serves as an interlayer film.

Claim 8 – In a semiconductor device with a MOS transistor, a reflection preventive film is formed on a gate electrode of the MOS transistor. The reflection preventive film is constituted by  $\text{Si}_x\text{O}_y\text{N}_z$  (x is a real number that does not include 0, y is a real number that includes 0 and z is a real number that does not include 0). A protective film is formed over the reflection preventive film and suppresses the change in the optical requirements of this reflection preventive film. The semiconductor device whose protective film is at least a part of the offset oxide film of the gate electrode.